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Applicant : MATSUSHITA ELECTRIC IND CO LTD

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Inventor :

10 OGINO YUJI

ISHIHARA TERUHISA

SHINSENJI SATORU

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# A METHOD OF PRODUCING A LIQUID CRYSTAL DISPLAY PANEL

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[Abstract]

PROBLEM TO BE SOLVED: To provide a manufacturing method for a liquid crystal display panel which can improve display quality by preventing a liquid crystal panel display part from having display unevenness.

20 SOLUTION: By the manufacturing method for the liquid crystal display panel constituted by dripping and charging liquid crystal between the internal surfaces of a couple of glass substrates having their periphery surrounded with a seal material, a first substrate 1 where a transparent conductive film 3, an inorganic insulating film 5, and an organic alignment layers 7 are formed in order and a second glass

substrate 2 which has an organic alignment layer 8 formed directly on a transparent conductive film 4 are prepared and after the liquid crystal 11 is dripped on the second glass substrate 2, the second glass substrate 2 and first glass substrate 1 are laminated together.

**[Claim(s)]**

[Claim 1]      A method of producing a liquid crystal panel which drops and fills a liquid crystal on inside of a pair of glass substrates that is surrounded by seal materials, wherein the method comprises the processes of:

- 5    preparing a first glass substrate in which a transparent conductive layer, a inorganic insulating layer, and organic alignment layer are generated in turn, and a second glass substrate in which said organic alignment layer is generated directly on the transparent conductive layer;
- dropping said liquid crystal on said second glass substrate; and
- 10   bonding said second glass substrate with said first glass substrate.

**[Title of the Invention]**

**A METHOD OF PRODUCING A LIQUID CRYSTAL DISPLAY PANEL**

**[Detailed Description of the Invention]**

**[Field of the Invention]**

- 5           This invention relates to a method of producing a liquid crystal panel, and more particularly, a method of producing a liquid crystal panel that is capable of avoiding display stains due to liquid crystal drop on a liquid crystal display portion.

**[Description of the Prior Art]**

- Typically, Liquid Crystal Display (referred to LCD hereafter) displays an  
10 image by converting a specific initial molecular arrangement of liquid crystal molecular to another molecular arrangement due to an effect of applying an electric field, etc and by using a change of an optical property of the liquid crystal cell that results from this molecular arrangement. Because LCD are preferably thin layer and light-weighted, and operates in lower voltage and lower power, as opposed to  
15 any other display device, it is used in various fields from OA that is representative of PC up to consumer electronics, industrial machine, etc,. Particularly, in LCD market of OA field, there is a need for uniform display without display stains of image in accordance with higher accuracy, higher capacity, and higher screen size.

Presently, in LCD market, there are simple matrix STN (Super Twisted Nematic) LCD and active matrix TFT (Thin Film Transistor) LCD. For example, STN LCD uses birefringence and rotatory polarization of light such that a liquid crystal molecular is pre-tilted at 3 degrees to 8 degrees and an arrangement direction of liquid crystal molecular between two substrates is twisted 180 degree to 270 degree, thereby to achieve the very sharp threshold characteristics, but it is important to disorder the molecular arrangement so that it achieves an uniform display without stains.

Conventionally, as a method of producing the liquid crystal display panel, there are generally proposed two methods as follows: One method is that glass substrate having oppositely disposed electrodes are bonded by seal materials having an opening prepared partially to surround a display cell area, it makes an empty panel of cell structure, and the liquid crystal is filled from the opening by a vacuum injection method using capillary and pressure difference. The other is a drop method of liquid crystal that can substantially reduce the amount of the time necessary to fill the liquid crystal in above vacuum injection method, for example a method such as disclosed in Japanese Patent Laid-Open No. 1987-89025, which will be described now with reference to figures.

Figure 2 is a diagram that illustrates processes according to the method of

producing prior art liquid crystal display panel, which are disclosed in above-mentioned Publication.

The method of producing the liquid crystal display panel according to the drop method of liquid crystal, generates an inorganic insulting layer 5 and an organic alignment layer 7 on a transparent conductive 3 in glass substrate 1 while arranging spacer 9 for maintaining a gap, and generates an inorganic insulting layer 6 and an organic alignment layer 8 on transparent conductive 4 in glass substrate 2 while generating seal materials 10 that surround a display cell area and dropping the predetermined amounts of liquid crystal 11 on the portion surrounded by the seal materials, with respect to substrates 1, 2 having conductive layers oppositely disposed as shown in figure 2(a). Thereafter, the invention provides the liquid crystal display panel by bonding the substrates under the reduced pressure. Figure 2(b) shows a cross-sectional view after bonding substrates 1, 2, and Figure 2(c) shows the top plane view of the same.

#### 15 [Problem(s) to be Solved by the Invention]

However, according to the method, since the inorganic insulating layers 5, 6 have been arranged on the transparent 3, 4 in the upper and lower glass substrate 1, 2 in order to prevent a short between the upper and lower glass substrates 1, 2 in the liquid crystal display panel, it is likely that liquid crystal drop-shaped stains

remain due to an electric charge of a dielectric polarization that may occur in an organic alignment layer 8 where liquid crystal is dropped, and display quality of liquid crystal panel is lowered, or display stains 12 occur as shown in Figure 2(c).

To avoid these facts, it cope with a heating process after sealing the liquid crystal,  
5 but it cannot erase the liquid crystal drop-shaped stains completely, as the result that it leads to deterioration of yield.

This invention resolves the above-mentioned problems and has objects to prevent display stains in liquid crystal display portion, and provide a method of producing a liquid crystal display panel that can improve a display quality.

#### 10 [Means for Solving the Problem]

A method of producing a liquid crystal panel of this invention is a method of producing a liquid crystal panel which drops and fills a liquid crystal on inside of a pair of glass substrates that is surrounded by seal materials, wherein the method comprises the processes of preparing a first glass substrate in which a transparent  
15 conductive layer, a inorganic insulating layer, and organic alignment layer are generated in turn, and a second glass substrate in which the organic alignment layer is generated directly on the transparent conductive layer; dropping the liquid crystal on the second glass substrate; and bonding that second glass substrate

with the first glass substrate.

According to this invention as described above, since it is possible to make escape ane electric charge of a dielectric polarization that may occur in the organic alignment layer 8 where liquid crystal is dropped, it allows the liquid crystal display  
5 panel to have advantages of preventing liquid crystal drop-shaped stains from occurring and improving display quality.

#### [Embodiment of the Invention]

The embodiment of this invention will be described now, with reference to figures. Further, like elements as prior art are denoted as like numerals.

10 Figure 1 is a diagram that illustrates a method of producing a liquid crystal display panel according to one embodiment of this invention.

With respect to substrates 1, 2 having conductive layers oppositely disposed as showed in Figure 1(a), the method of producing the liquid crystal display panel generates organic alignment layer 7 that consists of an inorganic  
15 insulting layer 5 and polyimide resin for arranging liquid crystal on a transparent conductive 3 in a glass substrate 1 while arranging spacer 9 for maintaining a gap, and generates an organic alignment layer 8 on a transparent conductive 4 in a glass substrate 2 while generating seal materials 10 that are surrounding display cell areas and dropping the predetermined amounts of liquid crystal 11 on the



portion surrounded by the seal materials. Thereafter the method provides the liquid crystal display panel by bonding the substrates under the reduced pressure. Figure 1(b) shows a cross-sectional view after bonding substrates 1, 2.

It is different from the prior art in that the organic alignment layer 8 is generated directly on the transparent conductive 4 but an inorganic insulating layer is not generated, with respect to the glass substrate 2 on which liquid crystal is dropped. More specifically with respect to the glass substrate 2, the transparent conductive layer 4 that is a part of panel display portion is generated by photolithography, and the organic alignment layer 8 consisting of polyimide resin is printed by flexographic printing thereon, cured at the predetermined temperature, and aligned by rubbing process.

On the glass substrate 2 that is achieved as described above, the predetermined amount of liquid crystal 11 is dropped. Then, it completes as shown in Figure 1(b) by bonding it to the other glass substrate 1 like the prior art.

Since only organic alignment layer 8 is generated on the transparent layer 4 without generating inorganic insulating layer and then liquid crystal is dropped as described above, it is possible to make escape the electric charge of the dielectric polarization that may occur in the organic alignment layer 8 where liquid crystal is dropped and prevent liquid crystal drop-shaped strains from occurring, thereby to

maintain stable molecular arrangement of the liquid crystal.

As it was described above, according to this embodiment, since only organic alignment layer is generated directly on the transparent layer 4 in glass substrate that will be a display portion without generating inorganic insulating layer, and then liquid crystal is dropped, it is possible to make escape the electric charge of the dielectric polarization that may occur in the organic alignment layer 8 where liquid crystal is dropped and prevent liquid crystal drop-shaped stains from occurring, with the result that it can maintain stable molecular arrangement of liquid crystal and realize the liquid crystal display panel of good display quality.

#### 10 [Effect of the Invention]

According to this invention as described above, it allows the liquid crystal display panel to have advantages of preventing liquid crystal drop-shaped stains from occurring and improving display quality.

**[Description of Drawings]**

Fig. 1(a) and 1(b) are diagrams that illustrate processes according to a method of producing the liquid crystal display panel of one embodiment of this invention.

- 5        Fig. 2(a) to 2(d) are diagrams that illustrate processes according to prior art method of producing liquid crystal display panel.